

# **Environmental Impact Assessment (EIA)**

# **CHAPTER I**

## **International Environmental Policies & Agreements**

# 1.1 Sustainable Development



- The World Commission on Environment and Development was initiated by the General Assembly of the United Nations in 1982.
- The commission then published its first report in 1987 entitled *Our Common Future*.
- The commission's membership was split between developed and developing countries.
- The reason for the foundation of this commission were
  - I. the 1972 Stockholm Conference on the Human Environment (*where the conflicts between environment and development were first acknowledged*)

- II. And in the 1980 World Conservation Strategy of the **International Union for the Conservation of Nature**, which argued for conservation as a means to assist development and specifically for the sustainable development and utilization of species, ecosystems, and resources.

- The commission urged:  
*‘the “environment” is where we live; and  
“development” is what we all do in attempting to  
improve our lot within that abode. The two are  
inseparable.’*
- The commission in its report also defined  
sustainable development as:  
*“ability to make development sustainable—to  
ensure that it meets the needs of the present  
without compromising the ability of future  
generations to meet their own needs”*

- The report was followed by major international meetings:
  - The United Nations Conference on Environment and Development (UNCED) which was held in Rio de Janeiro in 1992 (also called **Earth Summit**)
  - Ten years later to Earth Summit, World Summit on Sustainable Development was held in Johannesburg in 2002. (*Participants reaffirmed their commitments to Sustainable Development*)

# What is Sustainable Development?

- Sustainable Development is: A development that meets the needs of the present without compromising the ability of future generation to meet their own needs.
- Sustainable Development comprises of three objectives:
  - i. Economic & Social Development
  - ii. Environmental Protection
  - iii. Social Equity



## What is to be sustained?

### Nature

- Earth
- Biodiversity
- Ecosystems

### Life Support

- Resources
- Environment

### Community

- Cultures
- Groups
- Places

## For how long?

Now and in the future  
  
for ever

## What is to be developed

### People

- Child survival
- Life expectancy
- Education
- Equity
- Equal opportunity

### Economy

- Wealth
- Productive sectors
- Consumption

### Society

- Institutions
- States
- Regions

- Sustainable Development is economic and social development without a decline of the environment.
- It underlines that a healthy environment is essential to support economic development
- It seeks ways of living and working to enable all human kind to lead healthy, fulfilled and economically secured lives **without destroying the environment and without endangering the future welfare of people and the planet.**

## Group work 1

If you had your own business, say a factory producing textiles, and you wanted to operate according to the principles of sustainable development, what would you need to take into account?

- Sustainable development involves ‘meeting the needs of the present without compromising the ability of future generations to meet their own needs’.
- So, you would need to think about how your business would affect current and future generations.

- You would need to take into account the *three pillars of sustainability* – **economy**, **environment** and **society**.
- For **economy** you would need to consider both efficient and effective use of resources.
- For **environment** you should aim to use best practices that minimize the environmental impacts of your business.
- For **society** you would need to act responsibly and consider livelihoods, human health and well-being, equity, rights and quality of life, not just for current workers and their communities but for the future.

## Types of international collaboration initiatives and their characteristics

Type of initiative	Characteristics
Agreement	Can be used generically to mean international agreement in its broadest sense including the widest range of <i>international collaborations</i> . It can also be used more specifically to describe initiatives that are less formal than conventions or treaties and often deal with <i>a narrower range of subject matter</i> .
Convention	Generally used for formal multilateral treaties with many parties; <i>normally open for participation by the international community</i> as a whole, or by a large number of states. <i>A convention becomes legally binding on the states that sign up and ratify it.</i>
Treaty	<i>Embraces all agreements that are binding in international law</i> ; treaties are intended to create legal rights and duties. <b>A treaty</b> comes into force as an attempt to end conflict or disagreement between a few countries <b>whereas a convention</b> is an attempt by many countries to discuss global issues and reach an agreement to be followed by signatories.
Declaration	Usually used to <i>declare aspirations</i> rather than to create binding obligations.
Protocol	A supplementary document used to add detail or additional rights and obligations to a convention or treaty.

## **1.2 the Earth Summit**

- The United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, took place in Rio de Janeiro, Brazil, from June 2-14, 1992.
- The central focus was ***to relieve the global environmental system through the introduction to the paradigm of sustainable development.***
- The results of the UNCED includes:
  - I. Rio Declaration consisting of 27 principles of environment and development
  - II. Agenda 21
  - III. United Nations Framework Convention on Climate Change (UNFCCC)
  - IV. Convention on Biological Diversity

Four cornerstones of the Earth Summit	
Cornerstone	Summary
The Rio Declaration on Environment and Development	A set of principles which provide guidance on achieving sustainable development.
UN Framework Convention on Climate Change	An international treaty to stabilize greenhouse gas concentrations in the atmosphere.
Convention on Biological Diversity	An international convention with three objectives: <b>the conservation of biodiversity, the sustainable use of its components, and the equitable sharing of benefits from genetic resources.</b>
Agenda 21	A global programme of action for achieving sustainable development to which countries are politically committed rather than legally obligated.



## Rio Declaration on Environment and Development:

- the Declaration of Rio contains fundamental principles on which nations can base their future decisions and policies, **considering the environmental implications** of socio-economic development.

## **PRINCIPLE 1**

*Human beings* are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in *harmony with nature*.

## **PRINCIPLE 3**

*The right to development must be fulfilled* so as to equitably meet developmental and environmental needs of present and future generations.

## PRINCIPLE 4

In order to achieve sustainable development, ***environmental protection shall constitute an integral part of the development process*** and cannot be considered in isolation from it.

## PRINCIPLE 5

All States and all people shall **co-operate** in the essential task of **eradicating poverty** as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.

## **PRINCIPLE 6**

The special situation and needs of ***developing countries***, particularly the ***least developed*** and those most environmentally vulnerable, shall be given special priority. International actions in the field of ***environment and development*** should also address the interests and needs of all countries.

## **PRINCIPLE 8**

To achieve sustainable development and a higher quality of life for all people, states should ***reduce and eliminate unsustainable patterns of production and consumption*** and promote appropriate demographic policies.

## **PRINCIPLE 11**

States shall enact effective *environmental legislation*. Environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.

## **PRINCIPLE 13**

States shall develop national law regarding *liability and compensation* for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

## **PRINCIPLE 15**

In order to protect the environment, the *precautionary approach* shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

## **PRINCIPLE 17**

*Environmental impact assessment*, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

## **PRINCIPLE 18**

***States shall immediately notify*** other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.



## Agenda 21:

- Is international ***plan of action for Sustainable Development***, outlining key policies for achieving Sustainable Development that meets the need of the poor and recognizes the limits of development to meet global needs.
- Attempts to define a balance between production, consumption, population, development and the earth's life supporting capacity.

**Agenda 21** has 40 chapters that are broken up into four sections

1. Social and economic dimension

- Accelerating **Sustainable Development**
- Combating **poverty**
- Changing consumption pattern
- Population and sustainability
- Protecting and promoting **human health**
- Etc...

## 2. Conservation and management of resources

- Protecting the atmosphere
- Managing land sustainability
- Combating deforestation
- Combating desertification and draughts
- Conservation of Bio Diversity
- Protecting and managing fresh water resources
- Managing hazardous wastes

### 3. Strengthening the role of major groups

- Women in SD
- Children and youth in SD
- Strengthening the role of indigenous peoples
- Etc...

### 4. Means of Implementation

- Financing SD
- Technology transfer
- Science for SD
- Education, training and public awareness
- Etc...

# United Nations Framework Convention on Climate Change (UNFCC):

- UNFCC aims to "achieve ... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system."
- It states that "such a level should be achieved ***within a time-frame*** sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."

- Promotes the principles of ***common but differentiated responsibility*** and ***precautionary action***.
- The convention divides countries into two groups: Annex I and non-Annex I
- Annex I Parties are the **industrialized countries**, who have **historically contributed the most** to climate change.

*For example, North America and the European Union are jointly responsible for 85 percent of anthropogenic CO<sub>2</sub> emission.*

- Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere, the convention places a heavier burden on developed nations.
- This convention has mandated countries that have signed up to it to substantially reduce greenhouse gases (GHGs).

*For industrialized countries this is on an obligation basis and for developing countries on a voluntary basis.*

- UNFCCC urges Annex I countries to support climate change activities in developing countries by providing financial support for exclusively climate change related actions.
- Annex I countries are also urged to share technology with less-advanced nations.
- The Convention acknowledges the vulnerability of all countries to the effects of climate change and calls for special efforts to ease the consequences, especially in developing countries which lack the resources to do so on their own.



# The Kyoto Protocol

- Kyoto protocol was not among the immediate result of the Earth Summit but it was the extension of UNFCCC
- The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which **commits** its parties by setting internationally binding emission reduction targets.
- The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005.

- Parties with commitments under the Kyoto protocol have accepted targets for limiting or reducing emissions.
- Under the protocol, countries must meet their targets primarily through national measures.
- However, the protocol also offers them an additional means to meet their targets by way of other market-based mechanisms.
  - *Emissions trading*: countries that have emission units unused can sell this excess capacity to countries that are over their targets.

## Reduction targets as contained the Kyoto Protocol

Annex I parties	Emission limitation or reduction: first commitment period (2008 – 2012)
Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland	-8%
United States of America	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0%
Norway	+1%
Australia	+8%

Express in relation to aggregate GHG emission in the base year of 1990

## Group Work 2

1. Why is climate change a concern for the global community rather than just a concern for individual countries?
1. Why should climate change mitigation and adaptation activities be acted or implemented in global collaboration?

# **CHAPTER II**

## **Introduction to Environmental Impact Assessment (EIA)**

At the end of today's session, you will be able to:

- Define environmental impact assessment
- List the three main functions of EIA
- Acquire some of the important impact typologies

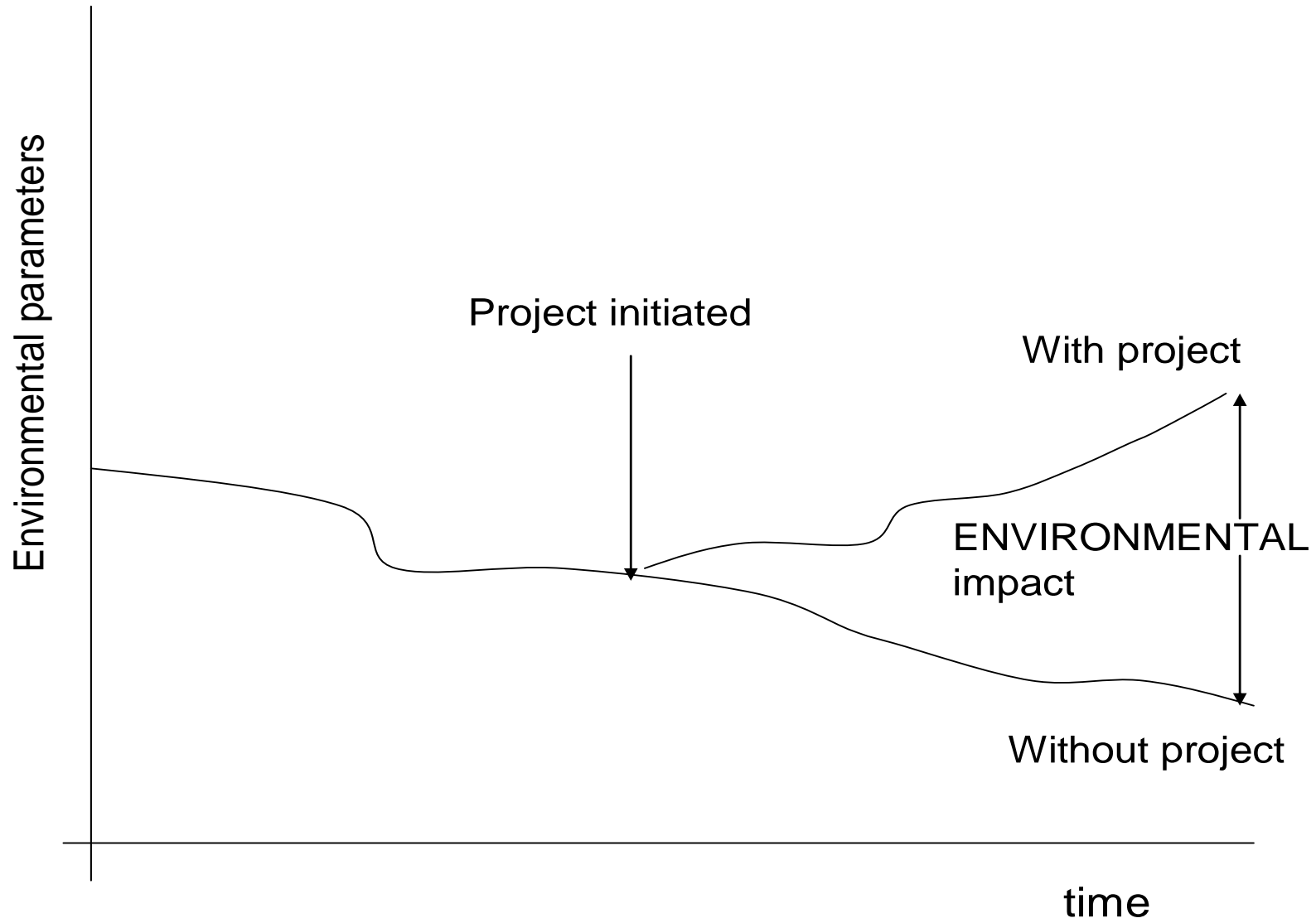
## **2.1 Defining EIA**

An EIA may be defined as:

- A formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and to augment positive effects. (*FAO definition*)
- A technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgments on whether the development should go ahead. (*UK's Department of the Environment, 1989*)



- Based on the above definitions, one can observe that EIA has three **basic functions**:
  - To predict problems,
  - To find ways to avoid them, and
  - To enhance positive effects.
- By accomplishing these functions, EIA promote **environmentally sound and sustainable** development through the identification of appropriate enhancement and mitigation measures.
- EIA also aims at providing information for decision-making on the environmental consequences of proposed actions



- The role of EIA is formally recognized in **Principle 17** of the Rio Declaration on Environment and Development:  
*Environmental impact assessment*, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

## Objectives of EIA

### Immediate objectives

- improve the environmental design of the proposal;
- ensure that resources are used appropriately and efficiently;
- identify appropriate measures for mitigating the potential impacts of the proposal; and
- facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal.

### Long term objectives

- protect human health and safety;
- avoid irreversible changes and serious damage to the environment;
- safeguard valued resources, natural areas and ecosystem components; and
- enhance the social aspects of the proposal.

- It is important to appreciate that EIA is not, in itself, a decision making process.
- It is a process that is integrated into existing decision making procedures in order to better inform decisions with respect to the environmental implications of the project.

## **2.2 Nature and Scope of Environmental Impacts**

- When undertaking EIA, a comprehensive view should be taken of the linkages and interactions among the issues under review
- The impacts of a development proposal examined in EIA can be direct, such as the effect of toxic discharge on air and water quality.
- Or indirect, such as the effect on human health from exposure to particulates or contaminants, which have built up in food chains.

## Typology of (Positive & Negative) environmental impacts

<b>Category of Impacts</b>	<b>Types of Impacts</b>
type	biophysical, social, health or economic
nature	Direct, indirect or cumulative, etc.
magnitude or severity	high, moderate, low
extent	local, regional, transboundary or global
timing	immediate/long term
duration	temporary/permanent
uncertainty	low likelihood/high probability
reversibility	reversible/irreversible
significance	unimportant/important

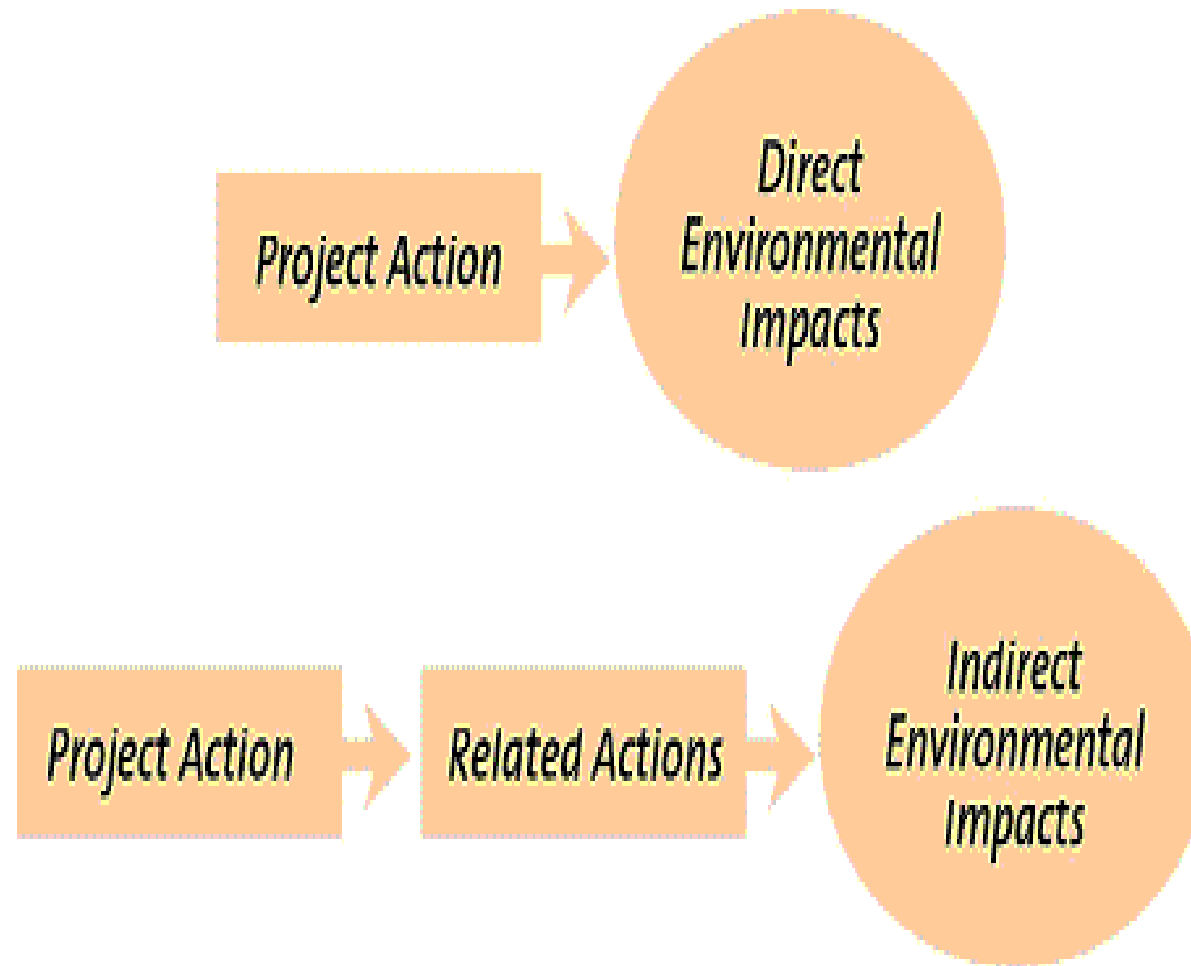


**Type (of Impact):** Environmental impacts can be of biophysical, social, health or economic:

- The biophysical environment includes living things (bio), **such as plants and animals**, and non-living things (physical), **such as rocks, soils, air and water**;
- Social impacts include all social and cultural consequences that alter the ways in which people live, work, relate to one another, organize to meet their needs etc...
- Health impacts refer to human health
- Economic impacts includes: employment, foreign currency, revenue, exchange of goods etc...

**Nature (of Impact):** Environmental impacts can be direct or indirect, or cumulative:

- Direct impacts are impacts caused directly by the project itself; *(these impacts are often easier to be identified and controlled than indirect impacts)*  
**Example:** Suppose the project is **construction of a new road**: land consumption, loss of top soil, removal of vegetation (plants) and/or farmland are examples of direct impact.
- Indirect impacts are impacts indirectly induced by the project *(Indirect impacts are more difficult to measure, but can ultimately be more important)*  
**Example:** loss of farmland as a result of road construction may affect local food security



## *Nature (of Impact): continued*

- Cumulative impacts: these impacts are cumulative and/or synergetic results of direct and indirect impacts
- Good example of such impact is the **climate change**
- Synergism is a condition in which the interaction of two or more substances results in a combined effect that is greater than the sum of their separate effects.

**pH Synergy** : When acid waters (waters with low pH values) come into contact with certain chemicals and metals, they often make them more toxic than normal.

*As an example,* fish that usually withstand pH values as low as **4.8** will die at pH **5.5** if the water contains 0.9 mg/L of iron.

**Magnitude (of Impact):** measures the size of damage or level of severity (for negative impacts) or benefits (for positive impacts).

- It is expressed in terms of relative severity, such as major, moderate or low.
- It is sensitive to reversibility, timing, duration and extent of impacts.

**Extent (of Impact):** The spatial extent or the zone of influence of the impact should always be determined. An impact can be:

- site-specific or limited to the project area;
- a locally occurring impact within the locality of the proposed project;
- a regional impact that may extend beyond the local area;
- a national impact affecting resources on a national scale and
- sometimes trans-boundary impacts, which might be international.

**Duration (of Impact):** Environmental impacts have a temporal dimension and needs to be considered in an EIA.

- Impacts arising at different phases of the project cycle may need to be considered.
- An impact that generally lasts for only 3 to 9 years after project completion may be classified as **short-term**.
- An impact, which continues for 10 to 20 years, may be defined as **medium-term**, and
- Impacts that last beyond 20 years are considered as **long-term**.



**Significance (of Impact):** places value on impact magnitude.

- It relates to the degree of vulnerability
- It relates to the importance society places on the resources affected,
- the importance of the impact to system stability and sustainability.

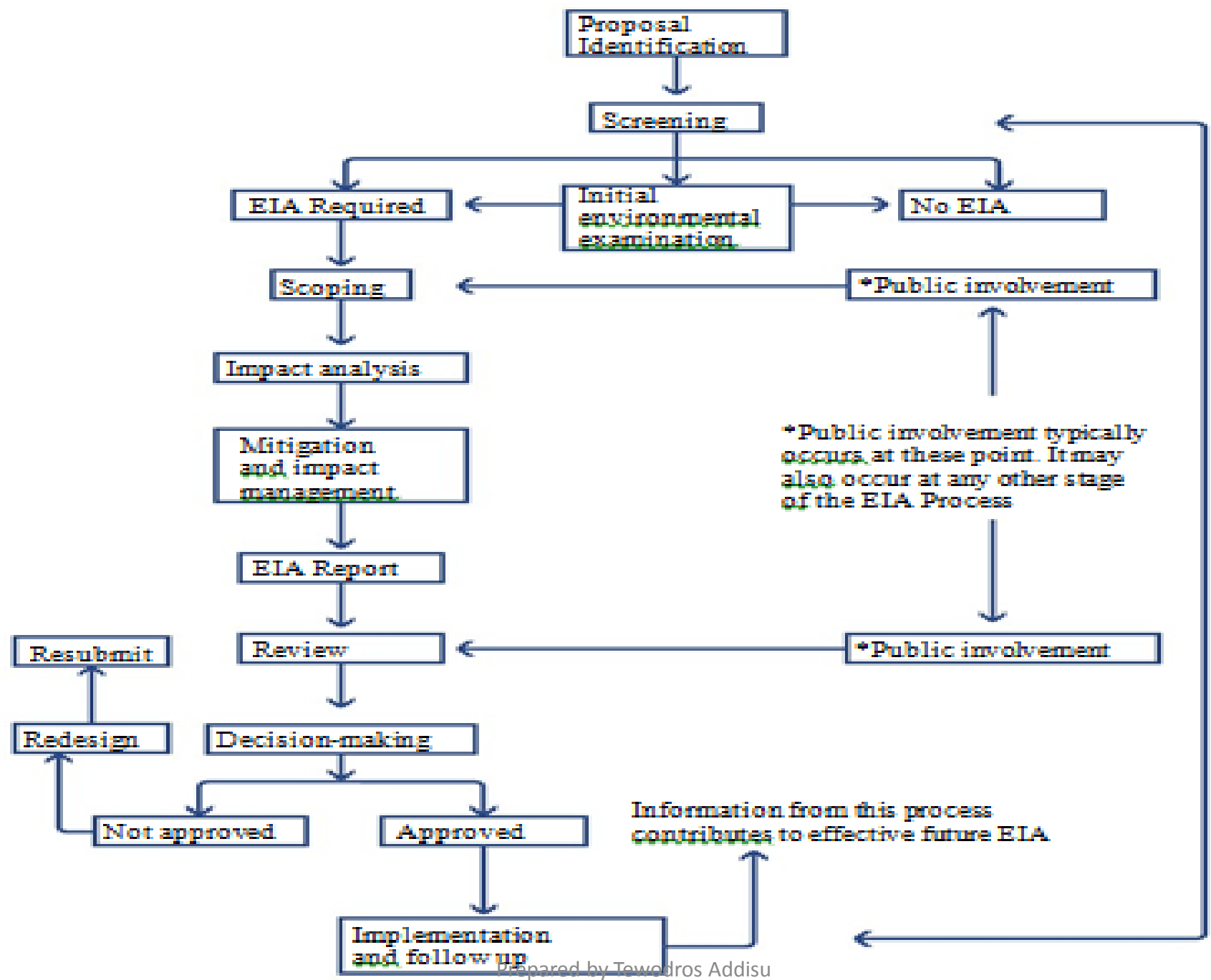
## **2.2 Key Elements of the EIA Process**

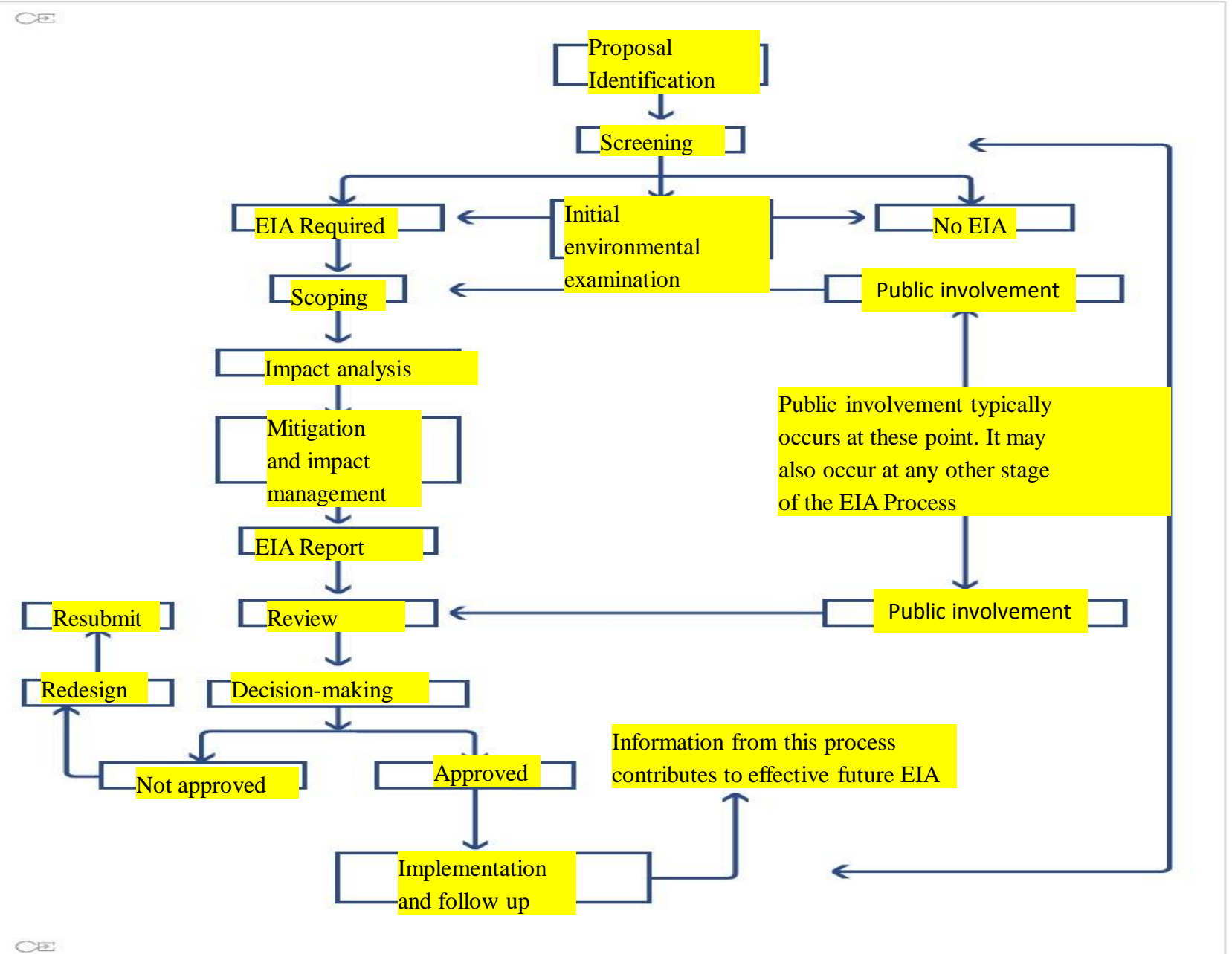
EIA systems can be described by reference to three components:

- the legal and institutional framework of regulation, guidance and procedure, which establishes the requirements for the conduct of EIA;
- the steps and activities of the EIA process, as applied to specific types of proposals; and
- the practice and performance of EIA, as evidenced by the quality of EIA reports prepared, the decisions taken and the environmental benefits delivered.

## EIA Process

- The particular components, stages and activities of an EIA process will depend upon the requirements of the country or donor.
- However, most EIA processes have a common structure and the application of the main stages is a basic standard of good practice.
- Typically, the EIA process begins with **screening** to ensure time and resources are directed at the proposals that matter environmentally.





## **Which type of projects under go EIA?**

- ✓ Agriculture
- ✓ Construction (Road networks, Malls, Townships, Dam etc)
- ✓ Industries
- ✓ Electrical projects
- ✓ Waste disposal
- ✓ Any developmental projects around Protected Areas / Nature Preserves
- ✓ Clean Development Mechanism CDM projects

## Group Work 3

1. Discuss and list some Major Projects that you know.
2. Discuss and list some key characteristics of Major Projects.



## *Characteristics of major projects*

- Substantial capital investment
- Cover large areas;
- Employ large numbers (construction and/or operation)
- Complex array of organizational links
- Wide-ranging impacts (geographical and by type)
- Significant environmental impacts
- Require special procedures
- Extractive and primary (including agriculture); services; infrastructure and utilities

# **CHAPTER III**

## **Components of EIA Process**

**What constitute good outcomes for EIA practice?** Where international standards apply or can be approximated, the following targets should be within the reach of EIA practice:

- screens out environmentally unsound projects;
- modifies the design of feasible proposals to reduce their environmental impact;
- identifies the best practicable environmental option;
- predicts the significant adverse effects of proposals with reasonable accuracy;
- identifies mitigation measures that work successfully to avoid, reduce and offset major impacts;

### 3.1 Screening (*is an EIA needed?*)

- Screening is the first key decision of the EIA process.
- The purpose of screening is to determine whether a proposal requires an EIA or not.
- The conduct of screening thus involves making a preliminary determination of the expected impact of a proposal on the environment and of its relative significance.
- A certain level of basic information about the proposal and its location is required for this purpose.

- The time taken to complete the screening process will depend upon
  - the type of proposal,
  - the environmental setting and
  - the degree of experience or understanding of its potential effects.

- The screening process can have one of four outcomes:
  - no further level of EIA is required;
  - a full and comprehensive EIA is required;
  - a more limited EIA is required (often called preliminary or initial assessment); or
  - further study is necessary to determine the level of EIA required.

Specific methods used in screening include:

- legal (or policy) definition of proposals to which EIA does or does not apply;
- inclusion **list of projects** (with or without thresholds) for which an **EIA is automatically required**; exclusion list of activities which do not require EIA because they are insignificant or are exempt by law (e.g. **national security or emergency activities**); and
- criteria for case-by-case screening of proposals to identify those requiring an EIA because of their potentially significant environmental effects.

## Further potential information sources for screening:

- a description of the proposal;
- applicable policies, plans and regulations, including environmental standards and objectives;
- the characteristics of the environment, including land use, significant resources, critical ecological functions, pollution and emission levels etc.;
- the degree of public concern and interest about the proposal.



World Bank Classification:

**Full and Comprehensive EIA** is required for projects or components:

*Dams and Reservoirs*

industrial plants (large scale);

*Irrigation and Drainage and flood control (large scale);*

*Land Clearance and Leveling (large scale);*

mineral development (including oil and gas);

*Pipelines;*

*Port and harbor development;*

*Reclamation and new land development*

*Resettlement*

*River basin development*

*Thermal and hydropower development*

*Urban water supply and sanitation,*

manufacture, transportation, and use of pesticides; etc...

- Limited EIA is required for projects:
  - agro-industries;
  - electrical transmission;
  - aquaculture and drainage (small-scale);
  - irrigation and drainage (small-scale);
  - renewable energy;
  - rural electrification;
  - tourism;
  - rural water supply and sanitation;
  - watershed projects (management or rehabilitation); and
  - rehabilitation, maintenance, and upgrading projects (small-scale).
- EIA is normally unnecessary for projects related to:
  - None

## 3.2 Scoping (*which impacts and issues to consider?*)

- The scoping process identifies the issues that are likely to be of most importance during the EIA and eliminates those that are of little concern.
- In this way, scoping ensures that EIA studies are focused on the significant effects, and time and money are not wasted on unnecessary investigations.
- scoping begins after the completion of the screening process.

Key objectives of scoping are to:

- inform the public about the proposal;
- identify the main stakeholders and their concerns and values;
- define the reasonable and practical alternatives to the proposal;
- focus the important issues and significant impacts to be addressed by an EIA;
- define the boundaries for an EIA in time, space and subject matter;
- set requirements for the collection of baseline and other information; and
- establish the Terms of Reference for an EIA study.

- The following public involvement methods are used in the conduct of scoping:
  - notification/invitation for public comment and written submissions;
  - consultation with the various stakeholders;
  - public and community meetings; and
  - issues workshops and facilitated discussion.

- The scoping process concludes with the establishment of **Terms of Reference (ToR)** for the preparation of an EIA.
- ToR sets out what the EIA is to cover, the type of information to be submitted and the depth of analysis that is required.

## ***Indicative list of scoping activity***

Activity	Items
Getting ready	<ol style="list-style-type: none"> <li>1. Prepare a preliminary or outline scope with headings such as: <ul style="list-style-type: none"> <li>• objectives and description of the proposal</li> <li>• the policy context and environmental setting</li> <li>• data and information sources, constraints etc.</li> <li>• concerns, issues and effects identified to date</li> <li>• provision for public involvement</li> <li>• timetable for scoping, EIA and decision making</li> </ul> </li> </ol>
	<ol style="list-style-type: none"> <li>2. Develop the outline scope by informal consultation and by assembling available information, identifying information gaps, etc.</li> </ol>
Undertaking scoping	<ol style="list-style-type: none"> <li>3. Make the provisional scope and supporting information available to the public.</li> </ol>
	<ol style="list-style-type: none"> <li>4. Draw up a long list of the range of issues and concerns.</li> </ol>
	<ol style="list-style-type: none"> <li>5. Evaluate their relative importance and significance to derive a short list of key issues.</li> </ol>
	<ol style="list-style-type: none"> <li>6. Organise the key issues into the impact categories to be studied.</li> </ol>
	<ol style="list-style-type: none"> <li>7. Amend the outline scope to progressively incorporate the information from each stage.</li> </ol>
Completion and continuity	<ol style="list-style-type: none"> <li>8. Establish the Terms of Reference for the EIA, including information requirements, study guidelines, methodology and protocols for revising work.</li> </ol>
	<ol style="list-style-type: none"> <li>9. Monitor progress against the ToR, making adjustments as needed and provide feedback to stakeholders and the public.</li> </ol>

Terms of Reference for a full EIA can refer to some or all of the following items:

- project background and description;
- study area or impact zone(s) (e.g. the affected environment and community);
- applicable policy and institutional considerations;
- the timeframe for completion of the EIA process;
- provisions for public involvement;
- alternatives to be examined;
- the impacts and issues to be studied;
- the studies to be carried out (e.g. approach, time & space boundaries);
- the requirements for mitigation and monitoring;
- the information and data to be included in the EIA report;



## Group Work 4

Imagine that you are an environmental consultant, and you have been commissioned by a proponent to undertake an EIA for Arba Minch Textile factory.

Compile a long list of impacts you would consider. Evaluate their relative importance and significance to derive a short list of key impacts.

### 3.3 Public hearing

- Nearly all EIA systems make provision for some type of public involvement.
- This term includes public consultation (or dialogue) and public participation, which is a more interactive and intensive process of stakeholder engagement.
- The purpose of public hearing is to:
  - » inform the stakeholders about the proposal and its likely effects;
  - » investigate their inputs, views and concerns; and
  - » take account of the information and views of the public in the EIA and decision making.

## Why does EIA need Public Hearing?

- To obtain local and traditional knowledge that may be useful for decision-making;
- To ensure that important impacts are not overlooked and benefits are maximized;
- To reduce conflict through the early identification of contentious issues;
- To provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal);
- To improve transparency and accountability of decision-making; and
- To increase public confidence in the EIA process.

## Levels and forms of public involvement

Level	Form of involvement
Informing	One way flow of information from the proponent to the public
Consulting	Two way flow of information between the proponent and the public with opportunities for the public to express views on the proposal
Participating	Interactive exchange between the proponent and the public encompassing shared analysis and agenda setting, and the development of understood and agreed positions on the proposal and its impacts
Negotiating	Face to face discussion between the proponent and key stakeholders to build consensus and reach a mutually acceptable resolution of issues, for example on a package of impact mitigation and compensation measures.

## Who are the Public?

- The range of public or stakeholders involved in an EIA typically includes:
  - » the people, individuals, groups and communities who are affected by the proposal;
  - » the proponent and other project beneficiaries;
  - » government agencies;
  - » NGOs and interest groups; and
  - » others, such as donors, the private sector, academics etc.

## ***The benefits of effective participation for different groups***

The Proponent	The Decision Maker	Affected communities
Raises the proponent's awareness of the potential impacts of a proposal on the environment and the affected community	Achieves more informed and accountable decision making	Provides an opportunity to raise concerns and influence the decision-making process
Legitimises proposals and ensures greater acceptance and support	Provides increased assurance that all issues of legitimate concern have been addressed	Provides an opportunity to gain a better understanding and knowledge about the environmental impacts and risks that may arise
Improves public trust and confidence	Demonstrates fairness and transparency, avoiding accusations of decisions being made 'behind closed doors'	Increases awareness of how decision-making processes work, who makes decisions and on what basis
Assists by obtaining local information/data	Promotes good relations with the proponent and third parties	Empowers people, providing the knowledge that they can influence decision making and creating a greater sense of social responsibility
Avoids potentially costly delays later in the process by resolving conflict early	Avoids potentially costly delays later in the process by resolving conflict early	Ensures all relevant issues and concerns are dealt with prior to the decision

## 3.4 Impact Analysis

- Impact analysis consists of the following three key process:
  - i. Impact identification: this involves preparing a further short listing of important impacts
  - ii. Impact prediction: this involves assessing the magnitude and extent of the identified impacts
  - iii. Impact evaluation: involves assignment of significance to predicted impacts associated with the projects

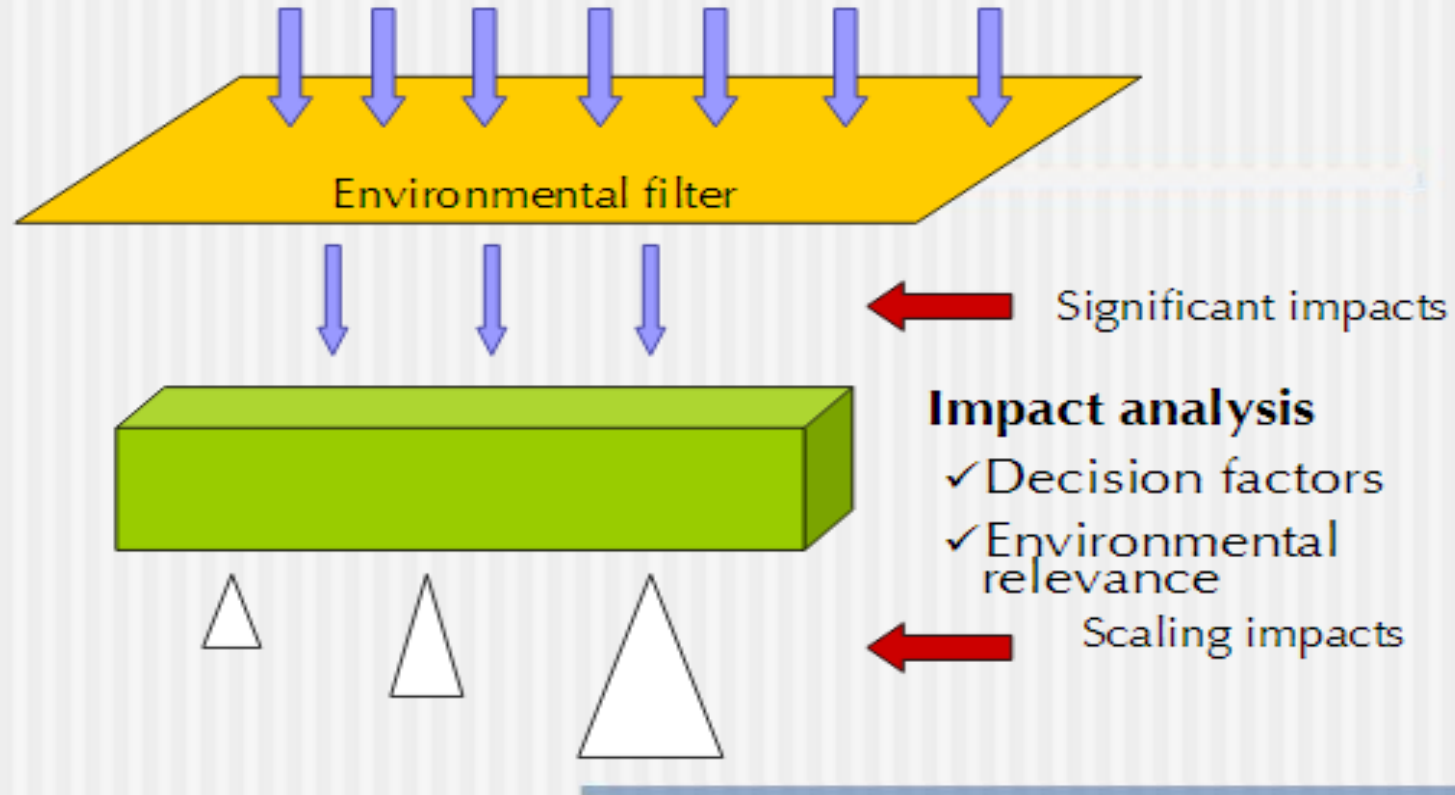
- An appropriate methodology or technique for impact analysis should be selected based on criteria: *some examples below*

<b><i>Criteria</i></b>	<b><i>Criteria Description</i></b>
Expertise Requirements	Simple enough to allow the available manpower with limited background knowledge to grasp and apply the method without difficulty.
Data Requirements	Does not require primary data collection and can be used with readily available data.
Time Requirements	Can be completed well within the time requirements for the EIA review.
Comprehensiveness	Comprehensive enough to contain all possible options and alternatives; able to give sufficient information about the impacts to enable effective decision-making.



# Finding the significance of impacts

All the possible effects of proposed project



- Some of commonly used methods in impact analysis include:
  - » Ad-hoc Methods
  - » Matrices
  - » Network Method
  - » GIS and map overlay
  - » Multicriteria analysis
  - » Simulation models
  - » Cost benefit analysis (CBA)
- The preferable approach is to undertake an integrated analysis.

- **Ad-hoc method** is useful when time constraints and lack of information require that the EIA must rely exclusively on expert opinion.
- Types of Ad-hoc method
  - » Expert opinions
  - » Checklists
  - » Ranking Methods
- Expert opinion on the impact of any activity can be sought by meeting with or writing to the experts and asking their answers to specific questions.
- Because of its speed and inexpensiveness this is vastly used in EIA's
- The fact that it is subjected to bias is a stern limitation.

- The most known three drawbacks of expert opinion carried out in the form of **panel discussions** are:
  - i. Halo effect: seniority effect
  - ii. Decibel effect: vociferous and assertive people may shadow views of exceptionally soft spoken and be quiet even if their views are more crucial or valuable
  - iii. Vanity effect: adherence to the views expressed before even after realizing their flaws. These people do not want to admit they are wrong or mistaken.

- Checklists mark the environmental features or factors that need to be addressed when identifying the impacts of projects and activities.
- Checklists can vary in complexity and purpose, from a simple checklist to a structured methodology or system that also assigns significance by scaling and weighting the impacts:
  - » *Simple Checklist*: a list of environmental impacts with no information on magnitude or importance of impacts.
  - » *Descriptive Checklist*: requires information on magnitude or importance of impacts.

- » *Scaling Checklist*: similar to a descriptive checklist, but with additional information on subjective scaling of the parameter.
- However, checklists are not as effective in identifying higher order impacts or the inter-relationships between impacts
- *Ranking method*: in this method, impacts are rated according to their significance and magnitude
- it involves assigning number values to each factors considered in the impact assessment.

## Sample for ranking approach

No	Types of impact	Weight given by		
		Person I	Person II	Person III
1	Air quality deterioration	7	7	9
2	Water quality deterioration	3	5	1
3	Land deterioration	9	4	9
4	Weed growth	0	1	2
5	Fisheries depletion	2	6	3
6	Noise pollution	10	10	10
7	Habitat loss	1	2	4
8	Fire hazard	0	1	0

- **Matrices:** are double entrance tables permitting establishment of relationships between:
  - » Project actions or activities (which are the causes) and
  - » The environmental factors (effects)
- The matrices can be simple with no magnitude and significance scaling or complex with magnitude and significance scaling



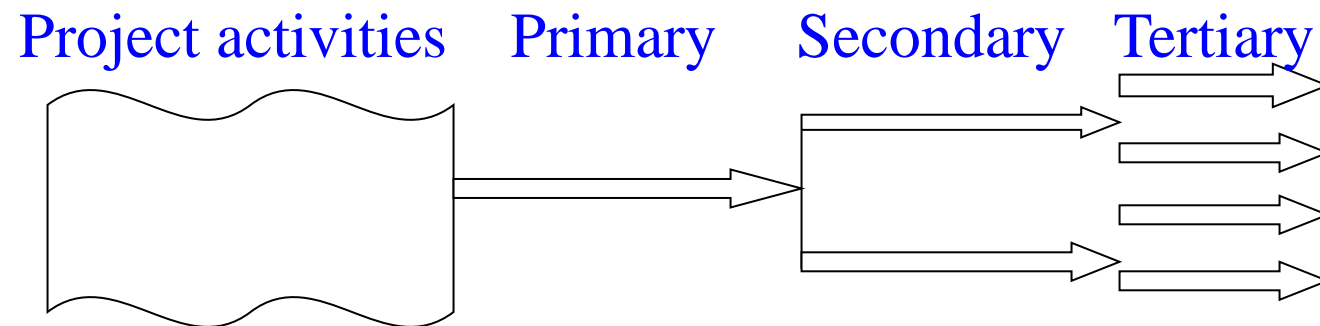
**Table 3-7:** Simple environmental impact matrix for the Phoenix Pulp Mill (*source:* Lohani and Halim, 1983).

Environmental Components	Project Activities								
	Plant Construction	Farming of Kenaf	Use of Pesticide Fertilizer	Transport of Raw Materials	Water Intake	Solid Waste	Effluent Discharge	Emissions	Employment
Surface Water Quality			X			X	X		X
Surface Water Hydrology					X				
Air Quality				X				X	
Fisheries			X				X		
Terrestrial Wildlife Habitat	X								
Terrestrial Wildlife	X								
Land Use Pattern		X							
Highways/Railways				X					
Water Supply			X				X		
Agriculture		X							
Housing									X
Health						X	X	X	
Socioeconomic									X

	Project activities							
	Plant construction	Farming of Kenaf	Use of pesticide fertilizer	Transport of raw materials	Solid waste	Water intake	Job opportunity	Etc..
Environmental factors								
Surface water quality			-2 / 1		-7 / 2			
Surface water hydrology						-7 / 5		
Socioeconomic							+8 / 4	
Etc...								

Magnitude (left-hand corner) and Importance or significance (right-hand corner). Scale 1 to 10. Values can still be signaled as positive (“+”) or negative (“-”).

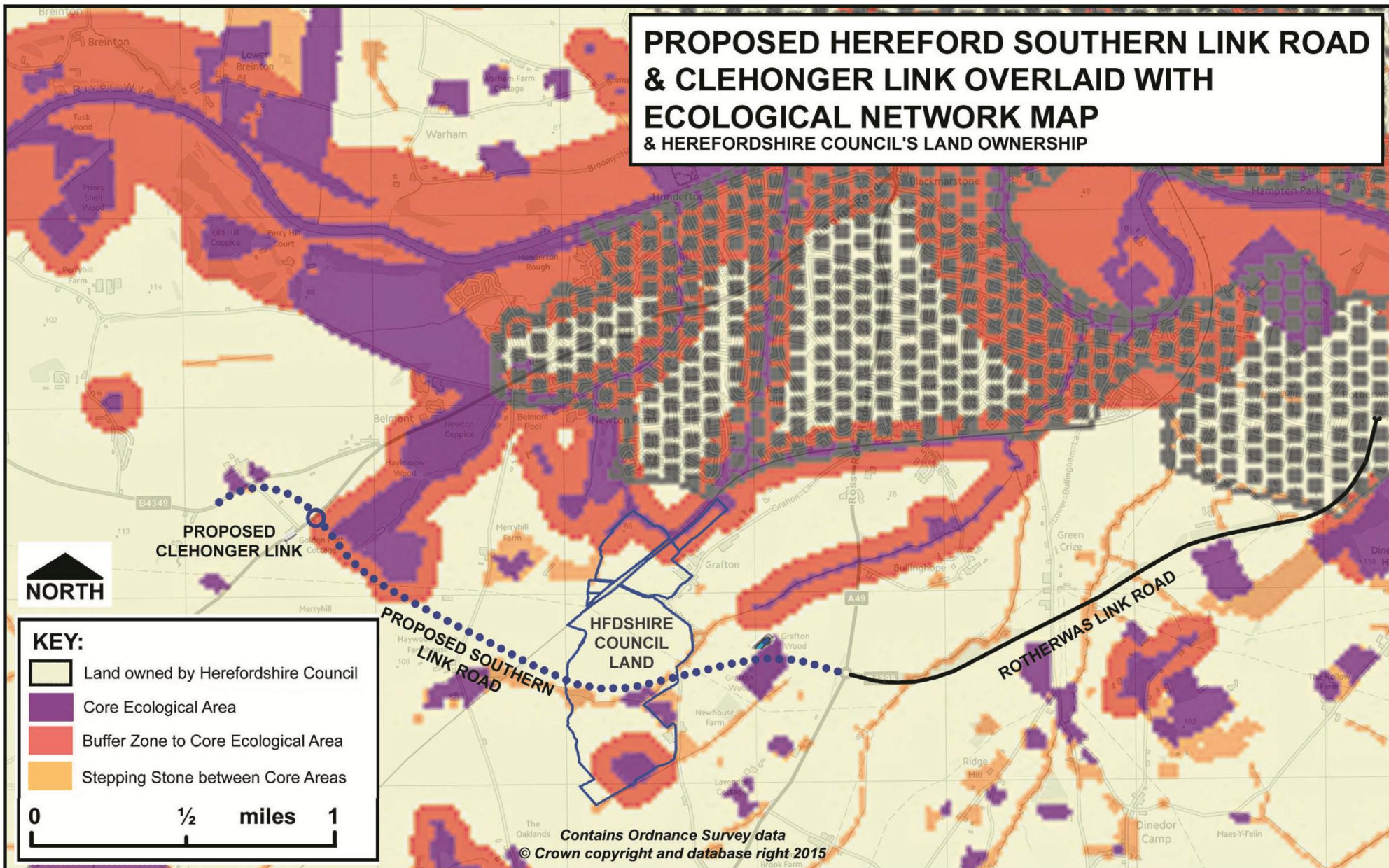
- **Network Method:** It uses the matrix approach by extending it to take into account primary as well the secondary impacts
- Shown in the form of tree called as impact tree
- Identification of direct, indirect and short, long term environmental impact is a crucial and intact basic step of making impact tree
- Used to identify cause-effect linkages



## **GIS and map overlay**

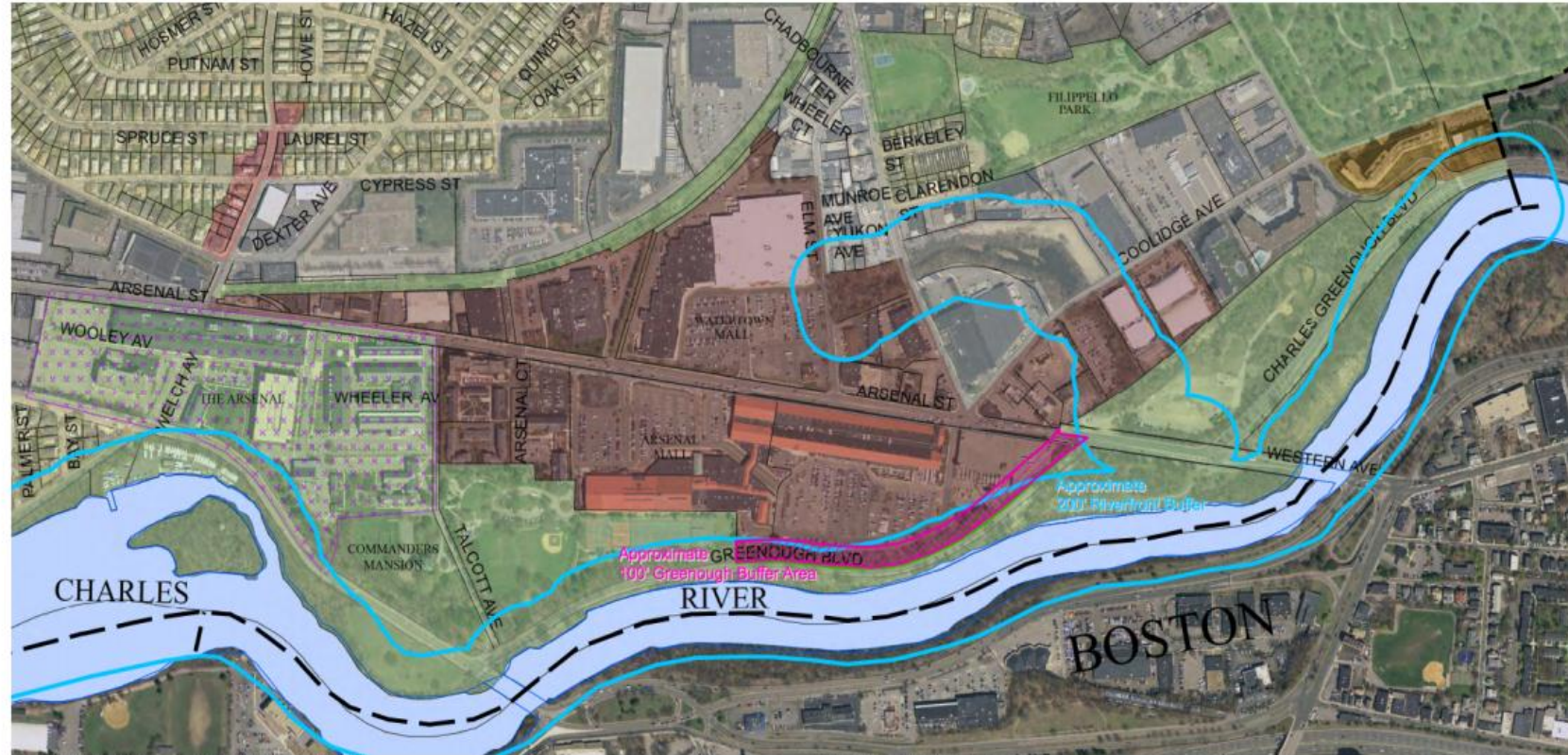
- The impact of development plans on the environment can be assessed by integrating data on land use with topographic and geologic information.
- GIS can show how a natural resource will be affected by a decision.
- GIS is also helpful in determining optimal routes for communications, irrigation, and road maintenance.
- It also helps to delineate what is known as “buffer zones” around points, lines, or polygons to indicate selected areas for special attention.

# PROPOSED HEREFORD SOUTHERN LINK ROAD & CLEHONGER LINK OVERLAID WITH ECOLOGICAL NETWORK MAP & HEREFORDSHIRE COUNCIL'S LAND OWNERSHIP



Contains Ordnance Survey data  
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## ZONING Map - Regional Mixed Use Amendment Greenough Buffer Analysis 11/30/2015



### MAP LEGEND

- PROPERTY LINE
- ROAD
- TOWN LINE
- WATER
- BRIDGE
- DAM
- DOCK

### ZONING DISTRICTS

- CENTRAL BUSINESS
- LIMITED BUSINESS
- NEIGHBORHOOD BUSINESS
- INDUSTRIAL - 1
- INDUSTRIAL - 2
- INDUSTRIAL - 3

- REGIONAL MIXED USE (RMUD)
- Pleasant Street Corridor-1 (PSCD-1)
- Pleasant Street Corridor-2 (PSCD-2)
- Pleasant Street Corridor-3 (PSCD-3)
- RESIDENTIAL .75
- RESIDENTIAL 1.2

- CLUSTER RESIDENTIAL
- SINGLE FAMILY (S-10)
- SINGLE FAMILY (S-6)
- SINGLE FAMILY CONVERSION
- TWO FAMILY
- OPEN SPACE/CONSERVANCY

### OVERLAY DISTRICTS

- HISTORIC OVERLAY DISTRICT
- ASSISTED LIVING OVERLAY
- ARSENAL OVERLAY DEVELOPMENT DISTRICT
- DESIGN OVERLAY DISTRICT
- RELIGIOUS/SCHOOL BUILDING OVERLAY
- LIMITED REDEVELOPMENT DISTRICT
- REVITALIZATION OVERLAY DISTRICT



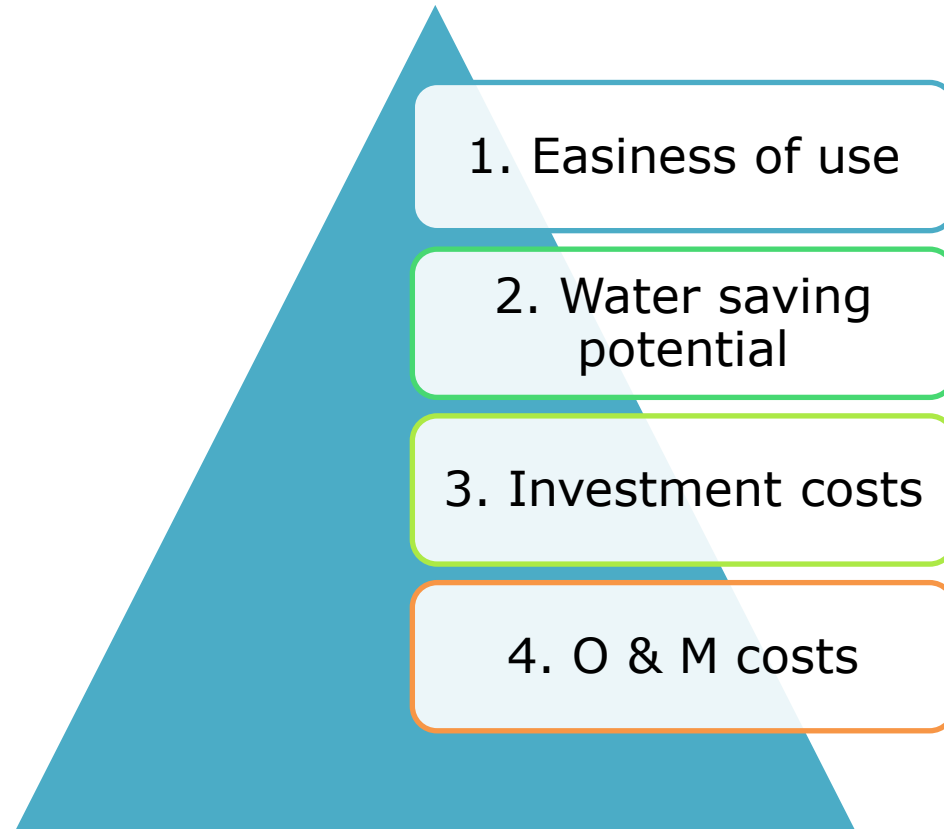
Map last updated November 30, 2015



## Multi-criteria analysis (MCA)

- Multi-Criteria Analysis is a decision-making tool developed for complex problems.
- It also aims to compare different actions or solutions according to a variety of criteria and policies.
- It involves applying different key criteria to determine the most suitable alternative.
- *For example*, if we are assessing the best irrigation system among furrow irrigation, drip irrigation, sprinkler irrigation and pivot irrigation.
- Such criteria as *easiness of use, water saving potential, investment costs and operation & maintenance costs* can be applied in the Multicriteria analysis.

- The criteria will be sorted in such a way that the most important criteria are on the first place and the least important on the last place.





- There are software with which we can carry out MCA: a good example is DEFINITE (decisions on a finite set of alternatives)

<https://spinlab.vu.nl/support/tools/definite-bosda/>

# Purpose and nature of the 4 types of measurement scale

Nature	Nominal	Ordinal	Interval	Ratio
<b>Type of Data</b>	Discrete	Discrete	Continuous	Continuous
<b>Description</b>	1)Items can only be put in groups, 2)Numerical Comparisons are impossible	1)Items can be categorized and ordered in higher or lower format, but numerical difference cannot be calculated	1)Numerical difference between values is meaningful 2)But Ratios cannot be calculated (60 degree Celsius is not twice hot as Thirty degree Celsius)	1)Ratios between two values are meaningful
<b>Meaningful Operations</b>	Percentage of Categories	Percentage of Categories	Addition and Subtraction of values	Addition, Subtraction, Multiplication and Division
<b>Analysis &amp; Interpretation</b>	Bar Graph & Pie chart	Bar Graph & Pie chart	All tools for continuous data	All tools for continuous data
<b>Example</b>	Count of Male & Female in a group	Customer Satisfaction Survey Index: How did you like our ice cream? Excellent/Very Good/ Just OK/ Not Good/Did not like it at all	Temperature	Weight

## Simulation models

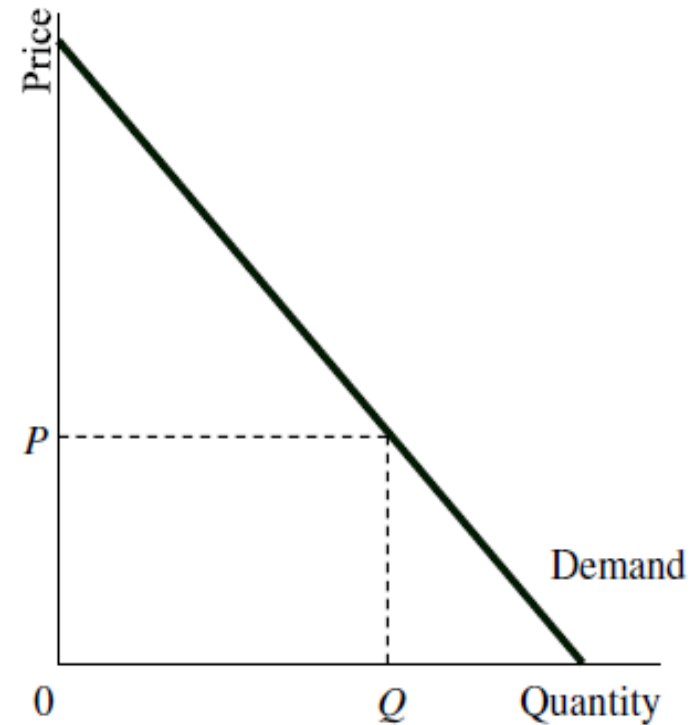
- Simulation models are a mathematical representation of the essential characteristics of a real-world system or situation, which can be used to predict future behavior under a variety of different conditions.
- Environmental models can serve as powerful tools in understanding ecosystems and potential impacts from development activities.
- Climate models, hydrologic models, Erosion models, reservoir sedimentation models, chemical fate and transport models are examples of environmental models to be used in EIA.

## **Cost benefit analysis (CBA)**

- Cost-Benefit Analysis (CBA) estimates and totals up the equivalent money value of the benefits and costs to the community of projects to establish whether they are worthwhile.
- If the value of the benefits exceeds the value of the costs then the project is worthwhile.
- This is equivalent to the condition that the net benefit must be positive.

Measuring benefits from a good:  
the **market demand curve**.

- Market demand  $Q$  at price  $P$  is the sum of individually demanded amounts at price  $P$ .
- Typically, when price is low, demand is high: demand curve has negative slope.
- Demand curve: how much do people buy at given price; *willingness to pay*.

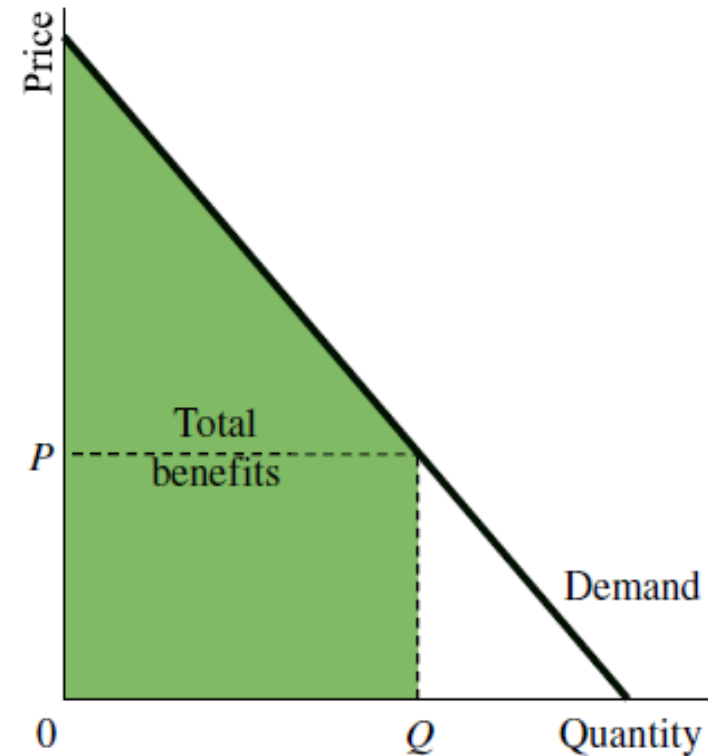


At price  $P$ , quantity  $Q$  is consumed

Total benefits to society of consuming quantity  $Q =$   
**Total willingness to pay**

Total willingness to pay equals the area under the demand curve, from the origin to the quantity consumed,  $Q$ .

In this graph, this area is shaded green.

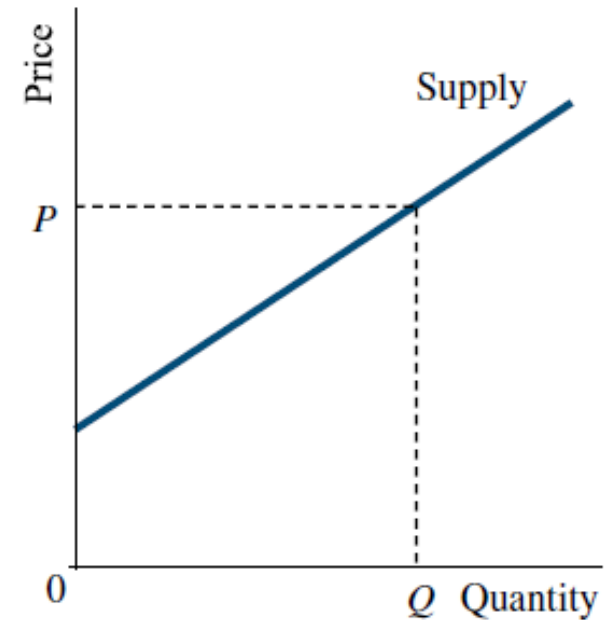


Measuring the costs of a good: the **market supply curve**

Market supply  $Q$  at price  $P$  is the sum of production of all firms at price  $P$

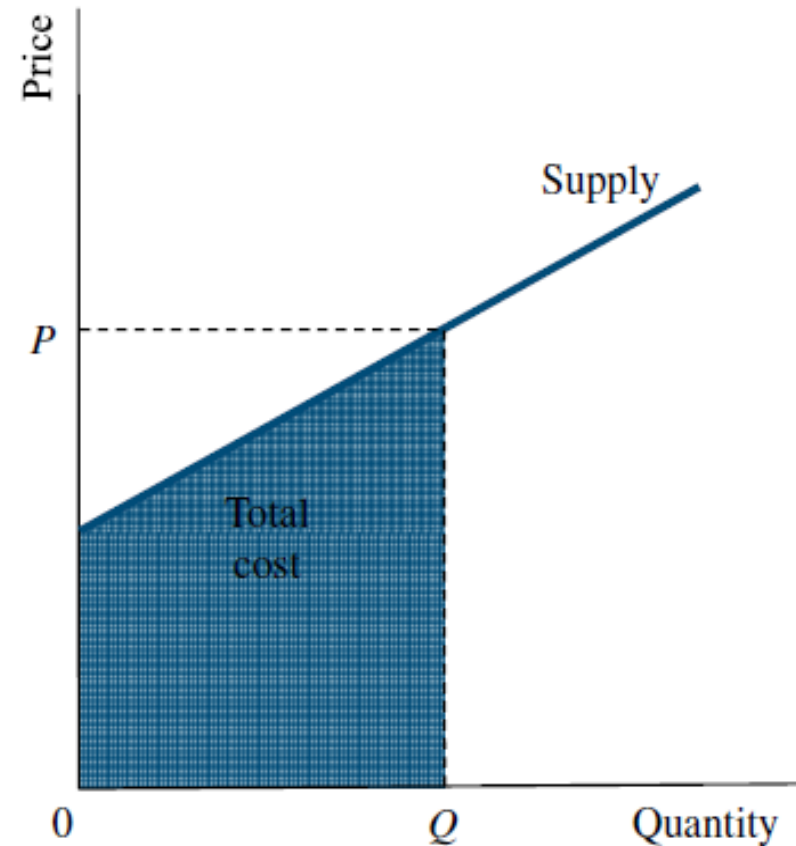
Typically, when price is high, supply is high: supply curve has positive slope

Supply curve represents the **costs** that producers make: at quantity  $Q$ , the costs of producing an additional unit are  $P$

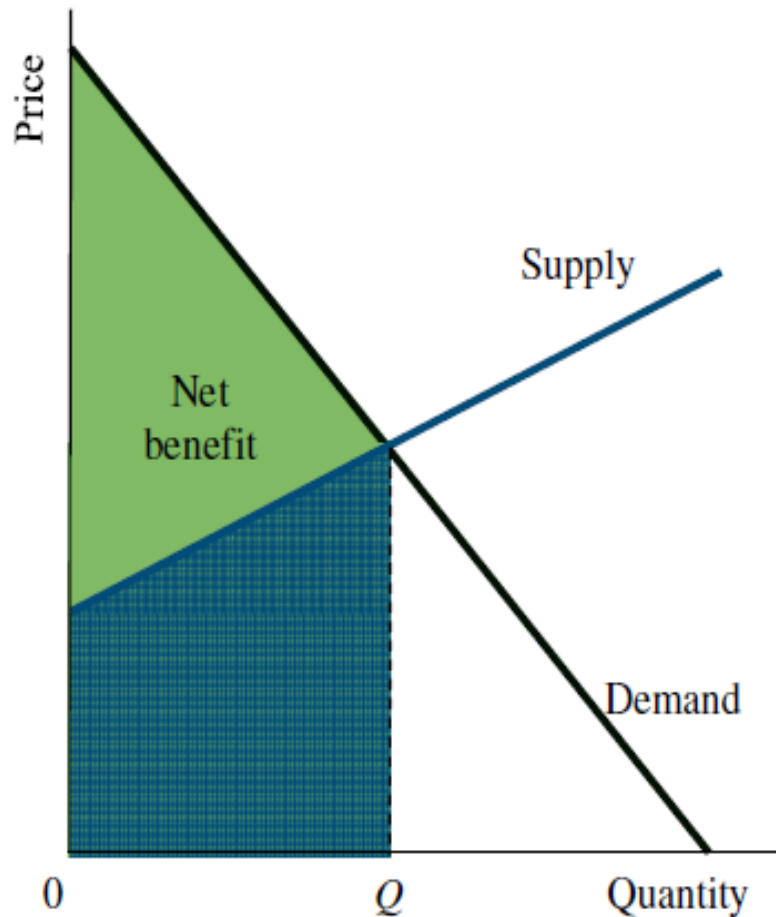


**Total cost** is the sum of the marginal costs: the area under the supply curve (marginal cost curve) from origin to quantity produced,  $Q$

In this graph, it is the blue area.







## Net benefit to society:

- Total benefits less total costs
- Measured as the part of the area under the demand curve (marginal benefits curve) that lies above the supply curve (marginal cost curve)

## 3.5 Mitigation and Impact Management

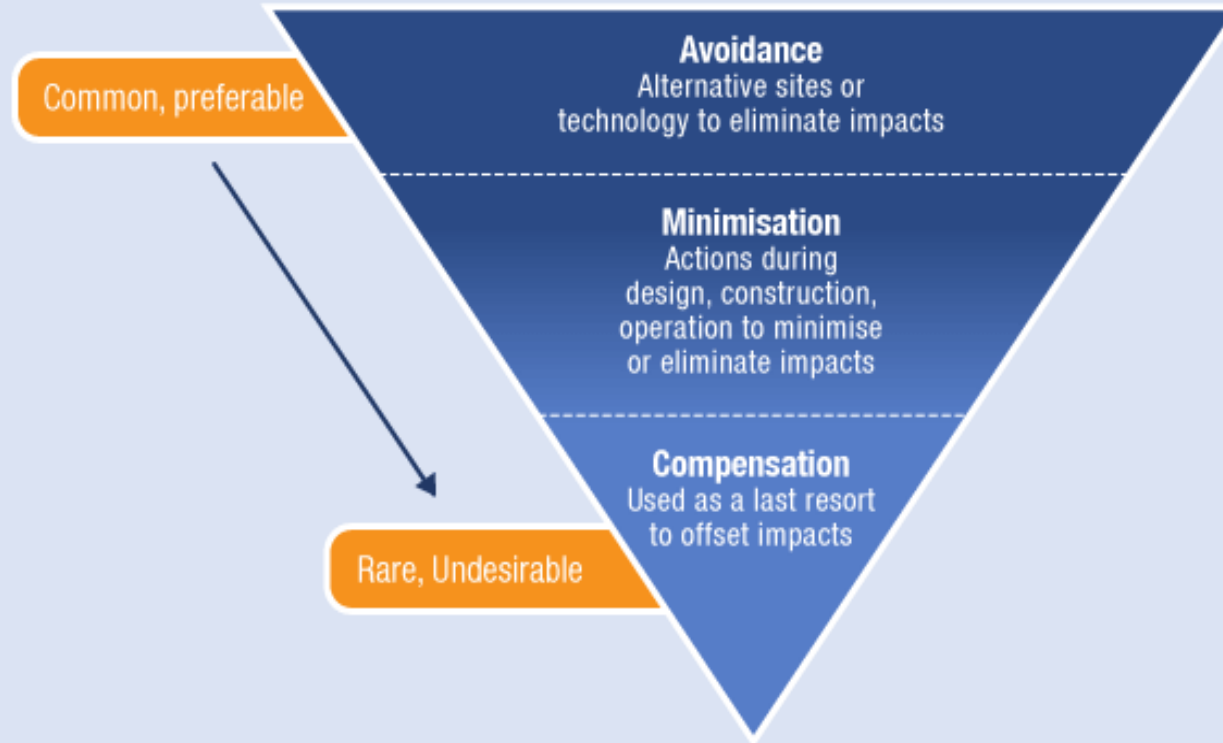
The objectives of mitigation are to:

- find better alternatives and ways of doing things;
- enhance the environmental and social benefits of a proposal;
- avoid, minimise or remedy adverse impacts; and
- ensure that residual adverse impacts are kept within acceptable levels.

## The Main Elements of Mitigation in a hierarchy of actions:

- I. first, avoid adverse impacts as far as possible by use of preventative measures;
- II. second, minimize or reduce adverse impacts to as low as practicable levels; and
- III. third, remedy or compensate for adverse residual impacts, which are unavoidable and cannot be reduced further.

## 7-2 The elements of mitigation



*Step One: Impact avoidance.* This step is most effective when applied at an early stage of project planning.

- It can be achieved by:
  - » not undertaking certain projects or elements that could result in adverse impacts;
  - » avoiding areas that are environmentally sensitive; and
  - » putting in place preventative measures to stop adverse impacts from occurring, for example, release of water from a reservoir to maintain a fisheries regime.

*Step Two: Impact minimization.* This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts.

- It can be achieved by:
  - » scaling down or relocating the proposal;
  - » redesigning elements of the project; and
  - » taking supplementary measures to manage the impacts

*Step Three: Impact compensation.* This step is usually applied to remedy unavoidable residual adverse impacts.

- It can be achieved by:
  - » rehabilitation of the affected site or environment, for example, by habitat enhancement and restocking fish;
  - » restoration of the affected site or environment to its previous state or better, as typically required for mine sites, forestry roads and seismic lines; and
  - » replacement of the same resource values at another location, for example, by wetland engineering to provide an equivalent area to that lost to drainage or infill.

Mitigation can be carried out by:

- *structural measures*, such as design or location changes, engineering modifications and landscape or site treatment; and
- *non-structural measures*, such as economic incentives, legal, institutional and policy instruments, provision of community services and training and capacity building.



The objectives of impact management are to:

- ensure that mitigation measures are implemented;
- establish systems and procedures for this purpose;
- monitor the effectiveness of mitigation measures;  
and
- take any necessary action when unforeseen impacts occur.